PowerMon

OPERATING MANUAL

KOLORIMETER
SILIKOMETER
IONOMETER
NATRIOMETER
TITROMETER

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BRAN+LUEBBE
An SPX Process Equipment Operation

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TABLE OF CONTENTS

1 INTRODUCTION 1
1.1 Conventions used in this manual 2

2 SAFETY ADVICES 3

3 OPERATION 4
3.1 Overview 4
3.2 Touch Screen 4
3.2.1 Initialization 5
3.2.2 Main display 6
3.3 Results 7
3.3.1 Table…… ..... ……7
3.3.2 Diagram 8
3.3.3 Info….9
3.4 Menu 9
3.4.1 System 9
3.4.2 Sensorlist 13
3.4.3 Parameter 13
3.4.4 Application 17
3.4.5 Service 22
3.4.6 Help… 25
3.5 Operating modes 25
3.5.1 Operating mode MEASURE 26
3.5.2 Operating mode CALIBRATION 27
3.5.3 Operating mode STOP 27
3.5.4 Operating mode ERROR 28

4 ERROR MESSAGES 29
4.1 Overview 29
4.2 Error messages overview 30

ANHANG A INDEX 1

LIST OF FIGURES

Fig. 3.1: Touch Screen 4
Fig. 3.2: Initialization a 5
Fig. 3.3: Initialization b 5
Fig. 3.4: Initialization c 5
Fig. 3.5: Initialization d 5
Fig. 3.6: Initialization e 5
Fig. 3.7: Initialization f 5
Fig. 3.8: Main display 6
Fig. 3.9: Results 7
Fig. 3.10: Table a 7
Fig. 3.11: Table b 8
Fig. 3.12: Table c 8
Fig. 3.13: Diagram a 8
Fig. 3.14: Diagram b 8
Fig. 3.15: Diagram c 8
Fig. 3.16: Info (results) 9
Fig. 3.17: Main Menu 9
Fig. 3.18: Password 9
Fig. 3.19: System 10
Fig. 3.20: Network 10
Fig. 3.21: IP-Address 10
Fig. 3.22: Info (Network) 10
Fig. 3.23: Clock menu 10
Fig. 3.24: Date 10
Fig. 3.25: Time 11
Fig. 3.26: Timezone 11
Fig. 3.27: Timedrift 11
Fig. 3.28: Shutdown a 11
Fig. 3.29: Shutdown b 11
Fig. 3.30: Modem 12
Fig. 3.31: Modem Port Setup 12
Fig. 3.32: Modem PIN 12
Fig. 3.33: Info (Modem) 12
Fig. 3.34: Display 12
Fig. 3.35: Language 12
Fig. 3.36: Sensorlist 13
Fig. 3.37: Parameter 14
Fig. 3.38: Meas.Point 14
Fig. 3.39: MP No 14

Fig. 3.40: MP NO choice 14
Fig. 3.41: Limits 14
Fig. 3.42: Sequence 14
Fig. 3.43: Current output 15
Fig. 3.44: Analog Output 15
Fig. 3.45: Signal Input 15
Fig. 3.46: Digital input 15
Fig. 3.47: Signal Output 16
Fig. 3.48: Digital Relay output 16
Fig. 3.49: Application 17
Fig. 3.50: Heating 17
Fig. 3.51: Calibration 18
Fig. 3.52: Concentration 18
Fig. 3.53: Factors 18
Fig. 3.54: Interval (Calibration) 18
Fig. 3.55: Sequence Program 18
Fig. 3.56: Measuring Program 18
Fig. 3.57: Meas. Prog. Selection 19
Fig. 3.58: Meas. Prog. Pumps 19
Fig. 3.59: Meas. Prog. Pump selection 19
Fig. 3.60: Meas. Prog. Valves 19
Fig. 3.61: Meas. Prog. Valve selection 19
Fig. 3.62: Meas. Prog. Relay 19
Fig. 3.63: Stirrer 20
Fig. 3.64: Digestor 20
Fig. 3.65: Device type Ionometer 20
Fig. 3.66: Device type Titrometer 20
Fig. 3.67: Titrometer configuration 21
Fig. 3.68: Min. span 21
Fig. 3.69: Service 22
Fig. 3.70: History 22
Fig. 3.71: Calibration history 22
Fig. 3.72: Calibration values history 22
Fig. 3.73: Error history 22
Fig. 3.74: Status history 22
Fig. 3.75: Status 23
Fig. 3.76: Manual Pumps 23
Fig. 3.77: Manual Valves 23
Fig. 3.78: Counter 24
Fig. 3.79:Counter 1 24
Fig. 3.80: Manual 24
Fig. 3.81: Help 25
Fig. 3.82: Info (System) 25

1 INTRODUCTION

The Bran+Luebbe PowerMon analyzers belong to a new generation of modern and fully automatic online analyzers. They continuously measure trace concentrations in liquid samples by using wet-chemistry methods. The manual describes the following analyzers:

- PowerMon Kolorimeter
- PowerMon Silikometer
- PowerMon Ionometer
- PowerMon Natriometer
- PowerMon Titrometer

We assume that operators have a basic technical knowledge.

Read this manual carefully before installing or commissioning the system. Keep this manual together with the User Manual near the system.

The manual is divided into the following sections:

SECTION 1	**INTRODUCTION**
SECTION 2	**SAFETY ADVICES**
SECTION 3	**OPERATION**
SECTION 4	**ERROR MESSAGES**
APPENDIX A	**INDEX**

If you have any questions or problems please contact our Service-Hotline:

HOTLINE PHONE:	**++49 (0)40/52202-505**
HOTLINE FAX:	**++49 (0)40/52202-317**

With systems where start-up or reagent supply has been contracted, vouchers for these services are supplied to the initial customer (e.g. project engineering office or first supplier).

1.1 Conventions used in this manual

Following marking is used:

- Capital letters are used to describe operating modes and functions, e.g. CALIBRATE.
- Bold letters are used to indicate the **keys** on the Touch Screen.

Following safety advices are used:

Danger:
Used if non-observance may result in serious injury or death.

Warning:
Used if non-observance may result in minor injury or serious damage to the system.

Caution:
Used if non-observance may result in minor damage to the system.

Used to indicate supplementary information or to call attention to recommendations that simplify daily operation.

2 SAFETY ADVICES

Use this device only for the purpose it is intended for. The owner has to take care that the system is only operated by qualified and well instructed staff. Pay attention to the safety precautions at all time.

Danger:
Pay attention to the safety precautions in the User Manual (Section 2).

3 OPERATION

3.1 Overview

This chapter contains information about routine operation procedures such as the use of the different operation modes, the functions and how to enter the operating parameters.

You will find descriptions about

- the Touch Screen (Section 3.2) and the function of the individual keys (Sections 3.3 and 3.4)
- the operating modes MEASURE, CALIBRATE, STOP and ERROR (Section 3.5)

3.2 Touch Screen

All entries and operating data scanning are made on the Touch Screen (Fig. 3.1). The key area is adapted to the respective display.

Fig. 3.1: Touch Screen

The function of the screens is described below.

3.2.1 Initialization

After the system is connected to the supply voltage it initializes and skips to the last operating mode. Following displays are shown onscreen:

Fig. 3.2: Initialization a

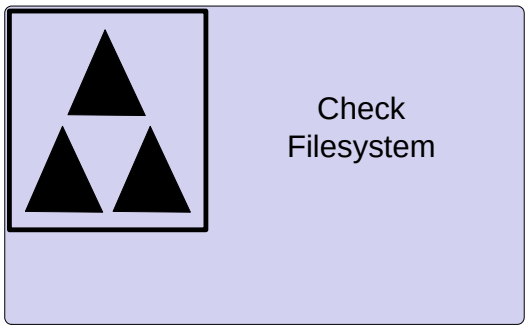


Fig. 3.3: Initialization b

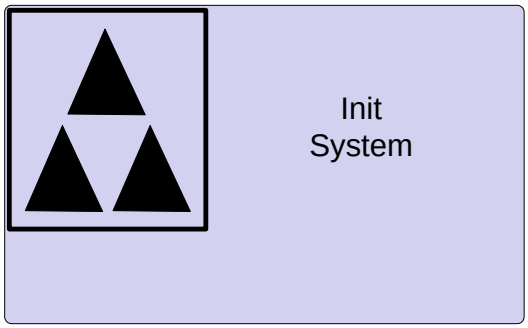


Fig. 3.4: Initialization c

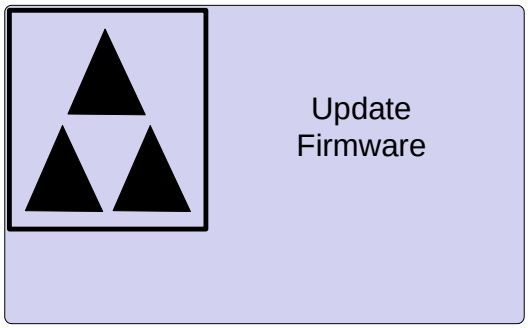


Fig. 3.5: Initialization d

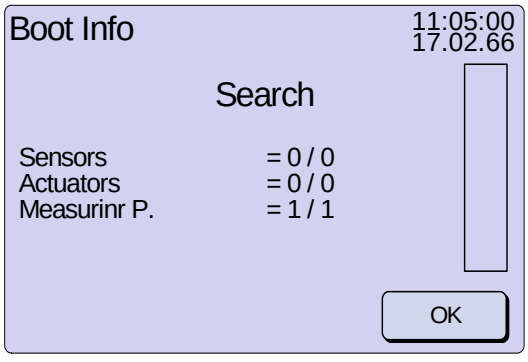


Fig. 3.6: Initialization e

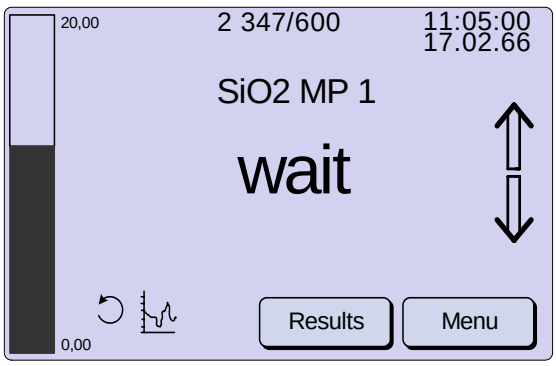


Fig. 3.7: Initialization f

In case of software update Fig. 3.5 is shown additionally. Afterwards the main display appears and the system is ready for operation.

3.2.2 Main display

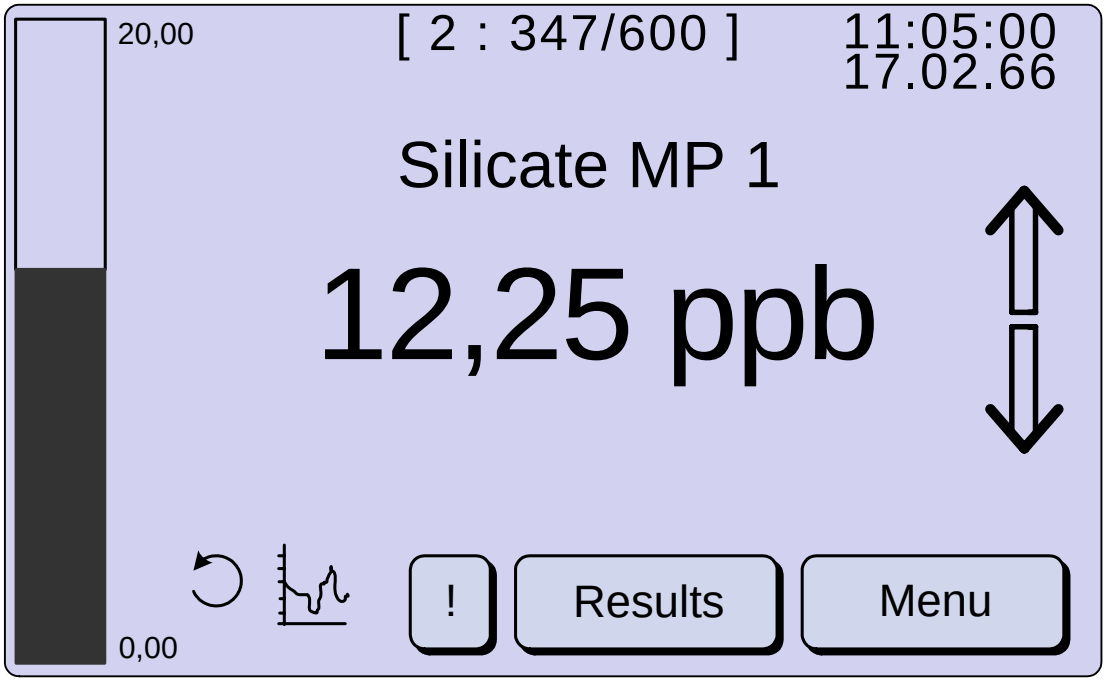


Fig. 3.8: Main display

Following information is shown on the display:

- Name of the measuring component
- Last sample value and unit.
- If a special measuring point is chosen, date and time of the last sample value are displayed in the right upper corner. In rolling display mode the current time is shown.
- On the left side a column shows the upper and lower limit of the measuring range and the actual sample value graphical.
- Up In the middle the actual measuring point is shown in squared brackets. During calibration C will be displayed and during rinsing R. Additionally the time is shown which already elapsed from the whole cycle time
- Via the arrow keys the values of further measuring points and external sensors (if available) can be displayed.
- ⓘ indicates that the measured value of a special measuring point is shown. You can switch to the rolling display mode by pressing this sign. Following symbol will appear: ↻
- To the right you find a symbol for the actual system status (refer to 3.5). These operating modes are shown: MEASURE, CALIBRATE, STOP, RINSE and ERROR.
- If warnings or errors exist you can recall a corresponding list by pressing the key **!**. The key is flashing if the error has not been receipted.

- Via the keys **Results** and **Menu** you gain access to all other display and entry screens.

3.3 Results

The PowerMon stores all measured values. Via **Results** you reach following screen:

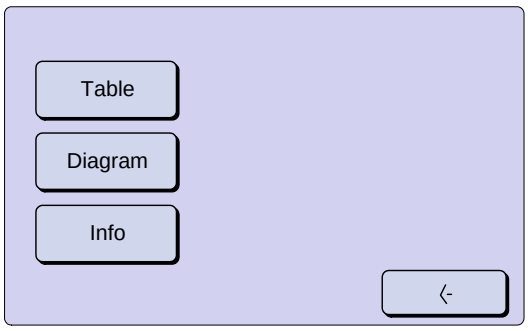


Fig. 3.9: Results

Here you can choose how the results will be displayed. Following possibilities are described below.

3.3.1 Table

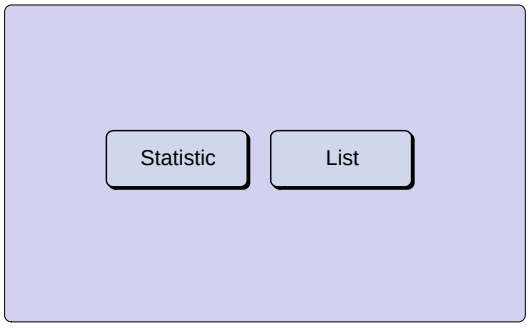


Fig. 3.10: Table a

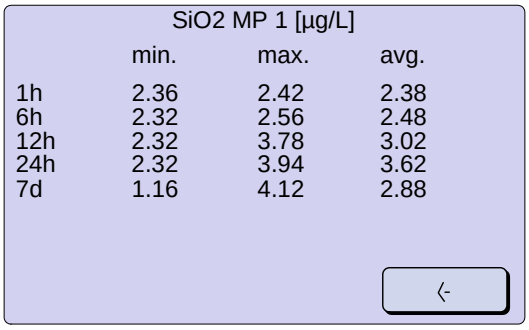


Fig. 3.11: Table b

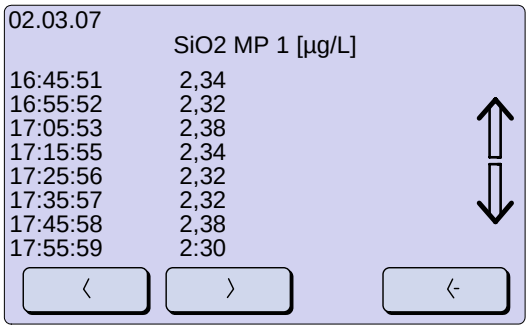


Fig. 3.12: Table c

Under **Table** two types of result-tables can be chosen. **Statistic** shows a table with min., max. and averaged results within different time intervals. **List** displays a table of all stored results of this measuring point. Via the arrow keys **<** or **>** you can choose the day and via ↑ and ↓ you scroll within the chosen day.

3.3.2 Diagram

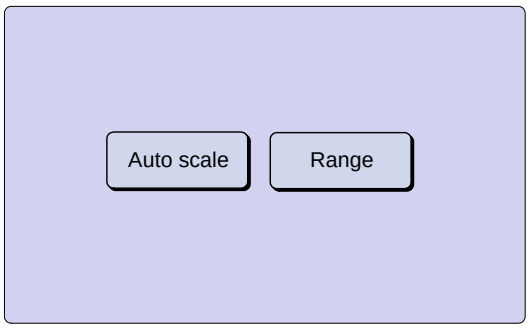


Fig. 3.13: Diagram a

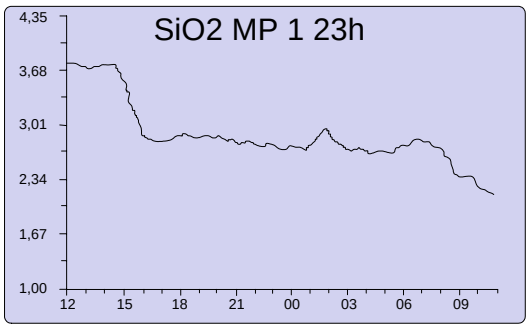


Fig. 3.14: Diagram b

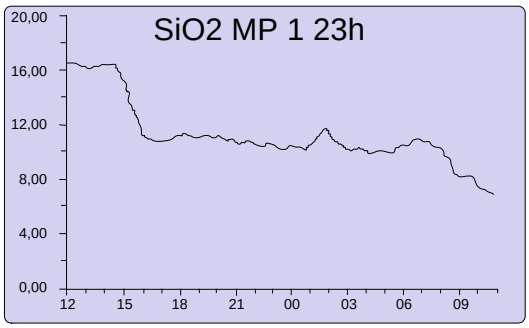


Fig. 3.15: Diagram c

Under **Diagram** you can choose the type of diagram. The diagram shows the tendency of the results during the last 23 hours. If **Auto Scale** is chosen the scaling of the Y-axis is determined by the min. and max. result during this period. **Range** shows the same trend with a fix scaling which is predetermined by the measuring range.

3.3.3 Info

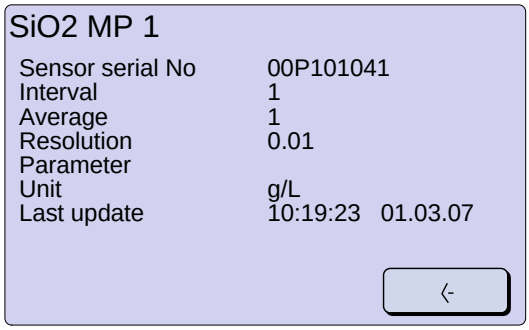


Fig. 3.16: Info (results)

Info (results) shows a summary of the fundamental settings for this measuring point. Those settings are normally predefined and cannot be changed.

3.4 Menu

Via **Menu** you gain access to all relevant operating parameters. These can be viewed and changed. **System**, **Sensorlist**, **Parameter**, **Application**, **Service** and **Help** are described below.

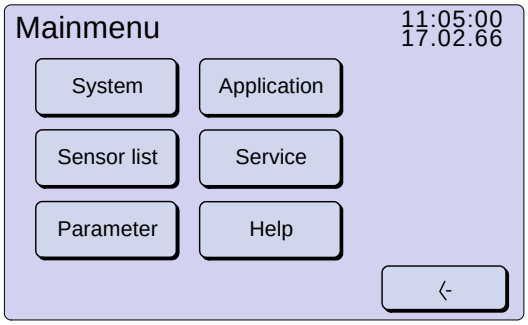


Fig. 3.17: Main Menu

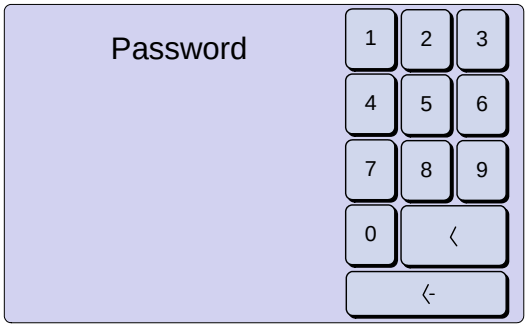


Fig. 3.18: Password

The menu item System requires a password. Data under this item are very critical! Only trained staff should make changes here.

3.4.1 System

Via **System** you reach following screen. The items **Network**, **Clock**, **Shutdown**, **Modem**, **GPS**, **Display** and **Language** are described below.

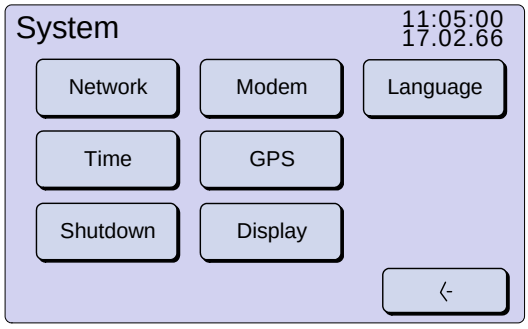


Fig. 3.19: System

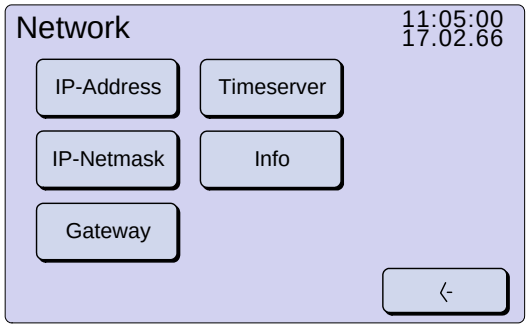


Fig. 3.20: Network

Network

Under **Network** all settings regarding the ethernet connection (LAN) are made. The data for **IP-Address**, **IP-Netmask** and **Default GW** (gateway) are entered via the numeric keypad. For the **Timeserver** a predefined setting can be chosen. Under **Info** all network settings are summarized.

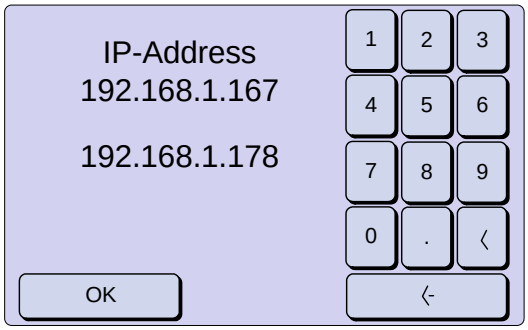


Fig. 3.21: IP-Address

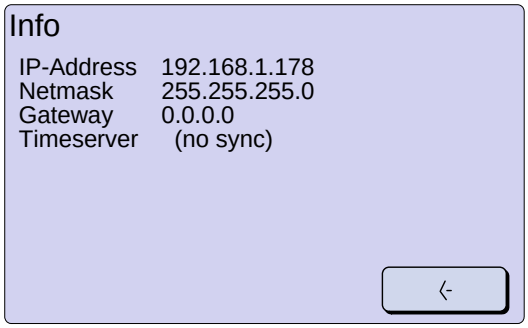


Fig. 3.22: Info (Network)

Clock menu

Under the item **Clock MENU** the settings for **DATE** and **TIME** are made. Please note that under **TIME** always the Greenwich Time must be entered. The local time can be customized under **TIMEZONE**. Technically conditioned drift of the PC-internal clock can be compensated under **TIMEDRIFT**.

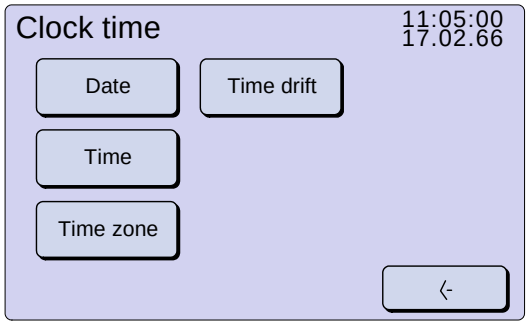


Fig. 3.23: Clock menu

Fig. 3.24: Date

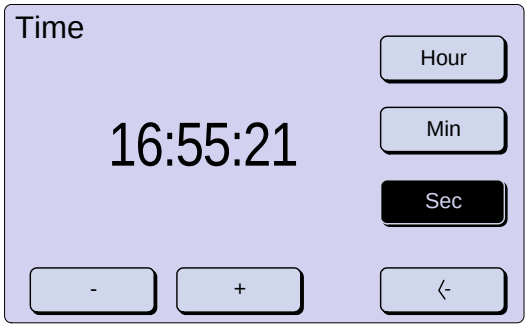


Fig. 3.25: Time

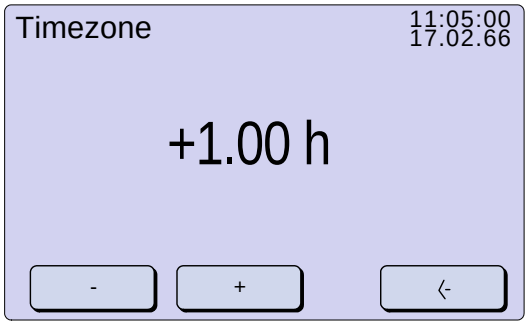


Fig. 3.26: Timezone

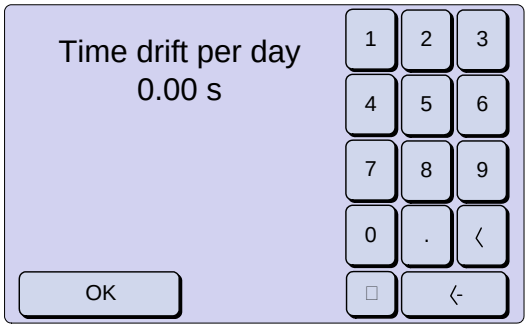


Fig. 3.27: Timedrift

Shutdown

After choosing **Shutdown** you are asked, whether the PowerMon should be shut down. Choosing „YES“ results in a predefined shutdown of the system. All data from the buffer are written to the compact flash card. During shutdown „PowerMon stops“ followed by „PowerMon is down“ is shown on the display. If the software has been updated the PowerMon must be switched off via **Shutdown** and restarted afterwards (interrupt the power supply for a few seconds) to activate the actualized software.

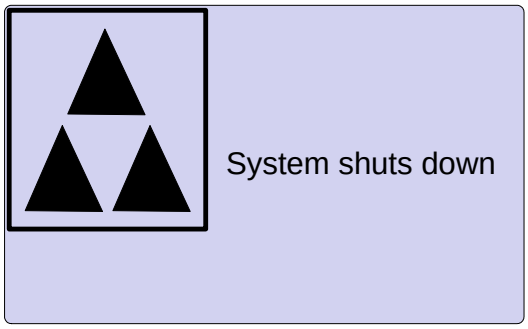


Fig. 3.28: Shutdown a

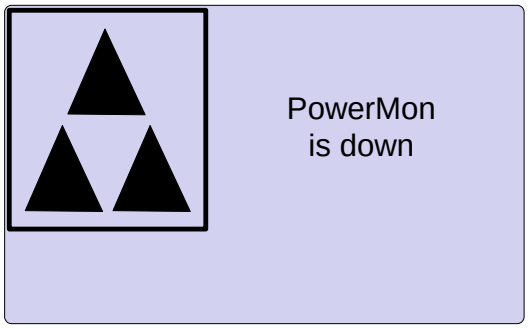


Fig. 3.29: Shutdown b

Modem

Under the item **Modem** you select the interface (**Port**) and enter the **PIN** via the numeric keypad. The modem must be mounted in advance and is usually connected to the serial interface. Depending on the type of modem the connection can be established analog, via ISDN or GMS.

If a modem is connected, data like signal quality, provider and IMEI are shown under **Info**. The **International Mobile Equipment Identity** (**IMEI**) is a unique 15-digit serial number which clearly identifies each GSM or UMTS terminal (mobile station).

The modem is an optional feature.

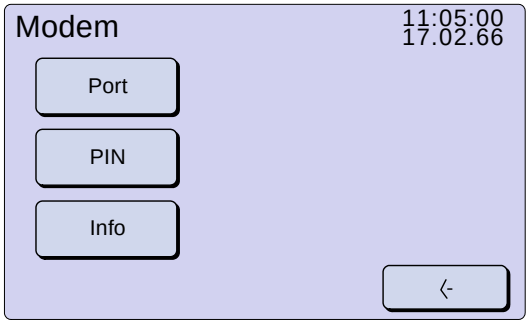


Fig. 3.30: Modem

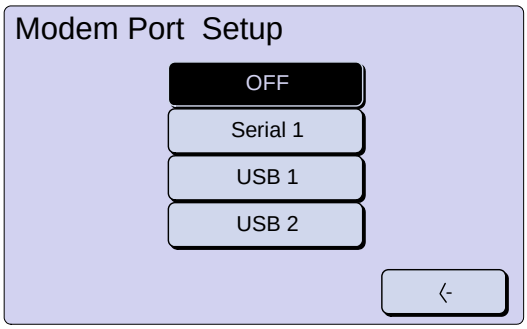


Fig. 3.31: Modem Port Setup

Fig. 3.32: Modem PIN

Fig. 3.33: Info (Modem)

GPS

Under the item **GPS** you select the interface (**Port**) and enter it via the numeric keypad (the GPS-module has to be connected in advance). Under **Info** the GPS-settings are summarized. If a GPS (Global Positioning System) Module is connected, the exact location of a PowerMon can be determined by satellite positioning.

Display

Via **Display** you can adjust the brightness of the Touch Screen by keystroke. The setting **high** apply to the active state, the setting **low** apply to the passive state of the display.

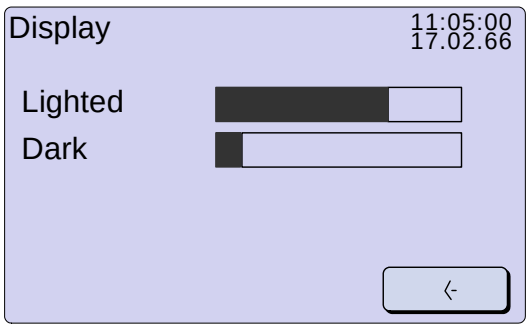


Fig. 3.34: Display

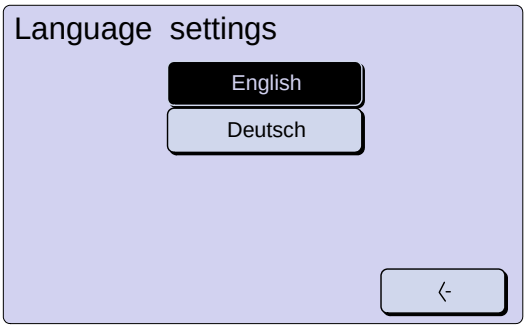


Fig. 3.35: Language

Language

Via **Language** you can choose between the available languages for the operational guidance. The changes will take place at once.

3.4.2 Sensorlist

Under the menu item **Sensorlist** the activated measuring points and the external sensors which are connected to the PowerMon are listed. By selecting one measuring point, respectively a sensor you reach the corresponding display like under **RESULTS** (main display, refer to section 3.3.)

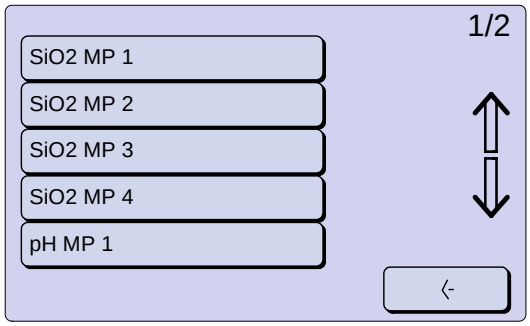


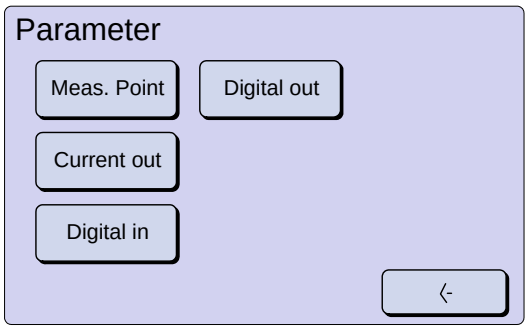
Fig. 3.36: Sensorlist

3.4.3 Parameter

Under the item **Parameter** the limit values of the individual measuring points can be entered. Additionally you can configure the analog signal outputs (current output) and the digital signal in- and -outputs. The items **Meas.Point**, **Analog, Digital** and **Relay** are described in the following.

Measuring Points

Under **Meas.Point – MP No** a list of the max. available measuring points is shown (indicated as **MP 1** to **MP 6**).



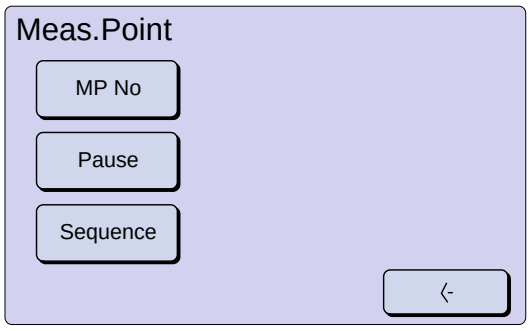


Fig. 3.37: Parameter

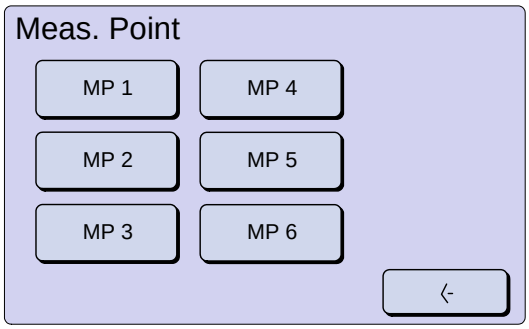


Fig. 3.38: Meas.Point

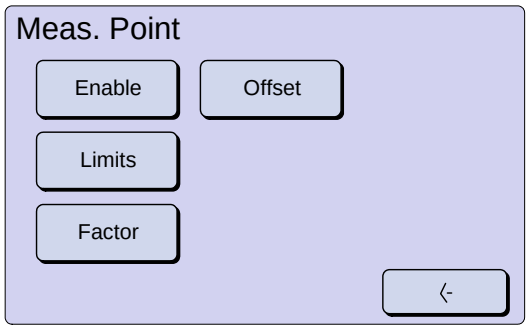


Fig. 3.39: MP No

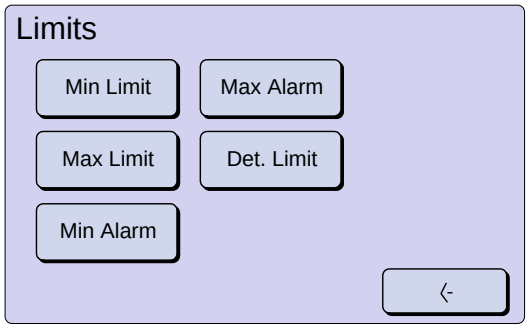


Fig. 3.40: MP NO choice

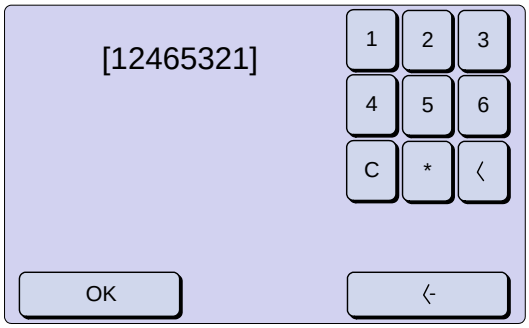


Fig. 3.41: Limits

Fig. 3.42: Sequence

By selecting a measuring point following inputs can be made (only valid for this specific measuring point):

OFF/ON	Pressing this key activates, respectively deactivates a measuring point.
Limits	Under this item the lower and upper limit of the measuring range can be entered via the numeric keypad for the corresponding measuring point (**Min./Max. Value**). This will influence the spread of the analog signal output directly (current output). Additionally the upper and lower alarm limits can be defined (**Min./Max. Alarm**). If the result falls below or exceeds this limits a digital output can be switched which is assigned by the system software. A corresponding error message is shown in the display. Via **Detection** the measurement detection limit for the measuring point is entered. If the result is lower than the entered detection limit the detection limit will be shown.
Factor	If your device is measuring e.g. ppm ammonia (NO_3-N) and you like the result to be shown as ppm nitrate (NO_3), you can enter a conversion factor here. This will influence the displayed result directly.
Offset	If a disturbing absorption of the sample or the reagents can not be compensated, you can enter an **Offset** which will directly influence the displayed value.

Additionally a time-out can be entered under **Pause**, which enlarges the interval between two measurements. Hereby the reagent consumption can be reduced if required.

Under the menu item **Sequence** you can enter the chronological order in which the measuring points of a multi-stream device will be analyzed. Additionally you can insert calibration cycles via entry of **C** or rinsing via *****. A sequence can consist of a maximum of 20 digits.

Current output

Under this menu item the available analog signal outputs can be configured.

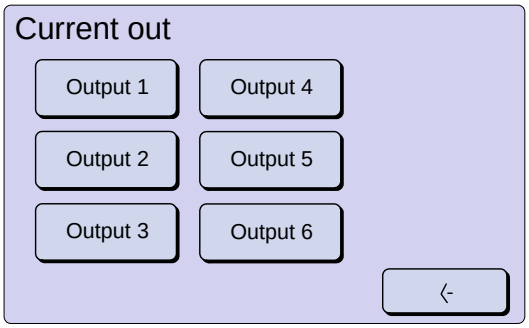


Fig. 3.43: Current output

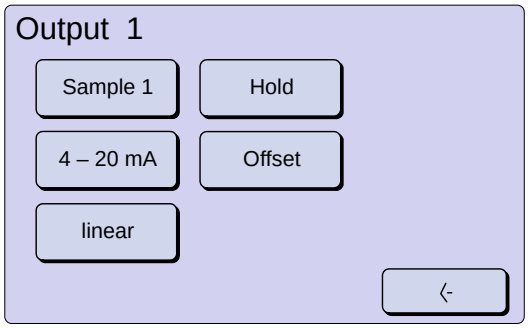


Fig. 3.44: Analog Output

After an output has been chosen the current configuration will be shown. You can change the configuration by multiple pressing of the corresponding key. The functions are described on the basis of the example in fig. 3.44.

MP 1	Linkage of the analog output with the result of a measuring point, respectively deactivation: **MP 1 – MP 6** and **off**
4 – 20mA	Predefinition of the zero point: **4 – 20 mA** or **0 – 20 mA**
Linear	Output scaling: **linear** and **logarithmical** (via 3 decades)
Hold	Predefinition of the error behavior: **Hold** (last result), **4 mA** or **0 mA**
Offset	An offset for the output (mA) can be entered via a numeric keypad. This setting corrects the analog value.

Signal Input

The response of the device to the digital inputs can be configured under this item. The device responses to a flank. The signal has to be present for at least 2 seconds. The actual configuration is shown after an input has been chosen. Multiple pressing of the corresponding key will change the configuration.

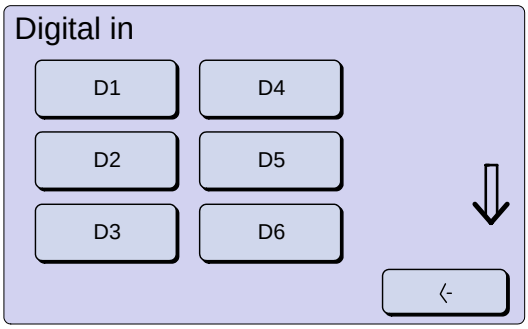


Fig. 3.45: Signal Input

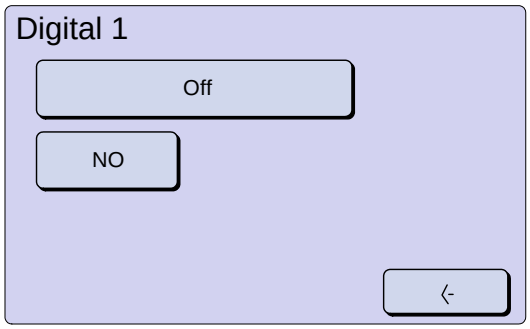


Fig. 3.46: Digital input

Activating and Deactivating of a measuring point is a special case. The signal has to be present as long as the desired action should be performed. If for example measur-

ing point 1 should not be measured intermediate the function **MP 1 active** has to be linked with a digital input and the marking has to be set with **NC**. If the contact is closed MP 1 will be taken out of the sequence. The functions are described on the basis of the example in fig. 3.46.

Off	Response of the device, following selection can be made: **Off** – no response, **Start** – starts the measurement, **Stop** – stops the measurement after the current cycle has ended, **Calibrate** – Start of a calibration, **Rinse** – Start of a rinsing cycle, **Sequence** – start of the measurement of a measuring point sequence followed by Stop, **Error reset** – resets all errors, **Meas.Point 1** to **Meas.Point 6** – activates/deactivates the corresponding measuring point.
NO	Determines whether the input is open or closed in the passive state: **NO** (normally open) and **NC** (normally closed)

Signal Output

Under this item the available digital outputs can be configured.

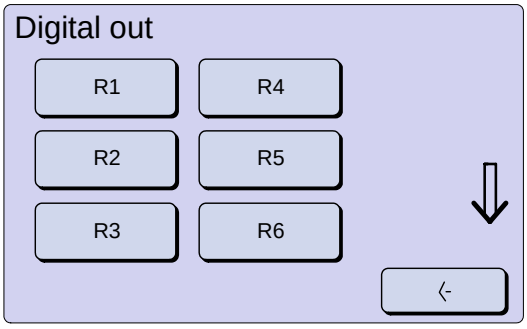


Fig. 3.47: Signal Output

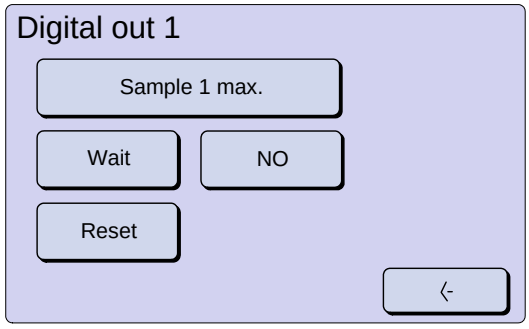


Fig. 3.48: Digital Relay output

After an output has been chosen the current configuration will be shown. You can determine the time for the switching of the relay by multiple pressing of the upper key. Following allocations are possible:

- Exceeding or falling below the alarm limits of a measuring point (e.g. **Sample 1 min**.)
- System alarm (**System**)
- Sample low MP 1 – 6 (e.g. **Sample low 1**)
- **Dilution water low**
- **Calibration solution low**
- **Calibration signal**
- **Measuring signal**
- No association (**Off**)

Via the key **Wait** you can enter a latency time. If an assigned alarm occurs the relay is pulled with the time delay that was entered in seconds.

Via the key **Reset** you can enter a reset time. If an assigned alarm occurs the relay is de-energized with the time delay that was entered in seconds.

Via the keys **NO/NC** you can determine whether the relay is open or closed in the passive state.

If a relay is already used in a sequence program you can not use it for another configuration.

3.4.4 Application

Under this menu item specific entries for an application can be made. Additionally the available sequence programs can be edited. The items **Heating**, **Calibration**, **Program**, **Stirrer**, **Cleaning**, **Digestor** and **Device type** are described below.

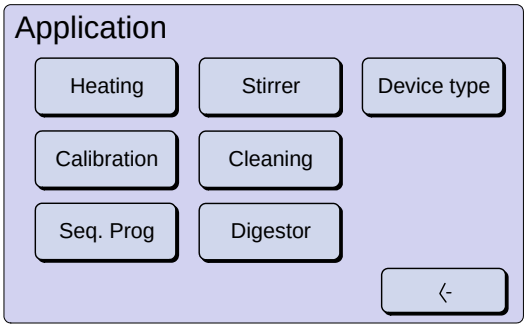


Fig. 3.49: Application

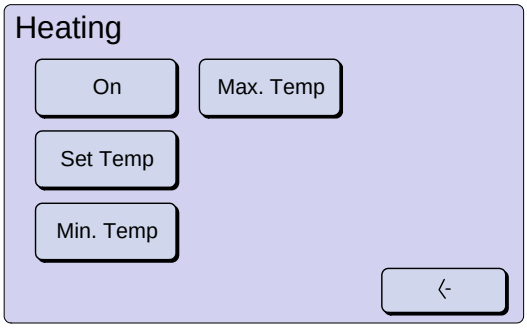


Fig. 3.50: Heating

Heating

Depending on the application a heating reactor or a sample heating may be necessary. Via the item **Heating** following entries can be made:

On/Off	This key activates or deactivates the heating circuit control.
Set Temp.	The set temperature is entered here.
Min. Temp.	This item defines the minimal tolerated deviation from the set temperature. An alarm will be generated if the temperature falls below this temperature limit.
Max. Temp.	This item defines the maximal tolerated deviation from the set temperature. An alarm will be generated if the temperature exceeds this temperature limit.

Calibration

Under the item **Calibration** the concentrations for the calibration solutions are entered (**Concentr**.). Depending on the application up to 3 different concentrations may be necessary. Furthermore up to 5 factors can be entered or viewed, which will influence the calibration equation as variables (**Factors**). Under **Interval** you can additionally define whether a calibration should be performed automatically and at which time. It is possible to initiate the calibration always at the same time or after a certain interval.

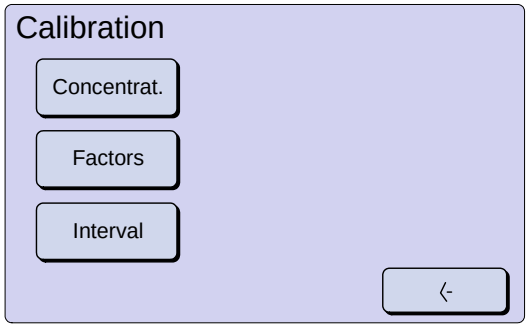


Fig. 3.51: Calibration

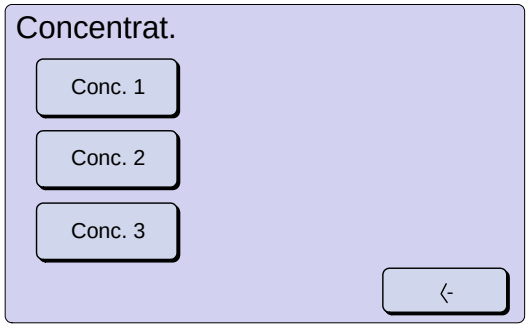


Fig. 3.52: Concentration

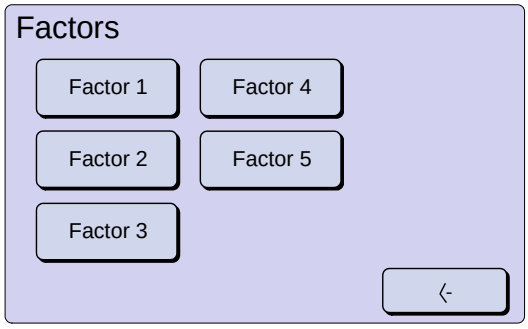


Fig. 3.53: Factors

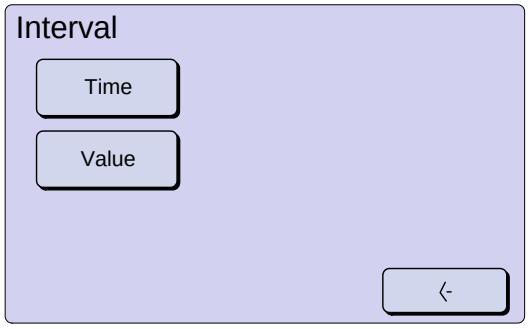


Fig. 3.54: Interval (Calibration)

Program

Via the item **Program** the available programs measuring program (**Meas Prog**), calibration program (**Cal Prog**), cleaning program (**Clean Prog**) and precleaning (**pre Clean**)can be edited. During the preclean program the selected outputs (keys are darkened) are activated for the whole cycle time of this program. The program **Meas Prog** can be edited separately for each measuring point (by selection of **MP 1** to **MP 6**). The procedure will be illustrated on base of the program for **MP 1**. The other programs are edited accordingly.

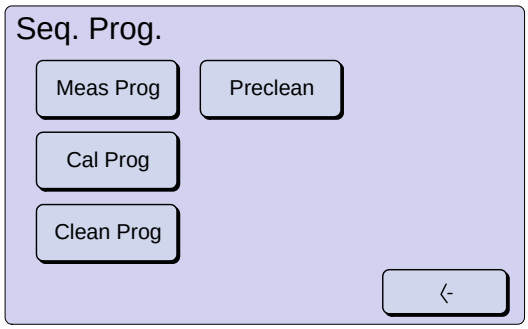


Fig. 3.55: Sequence Program

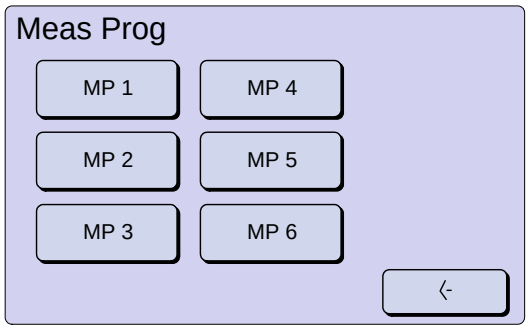


Fig. 3.56: Measuring Program

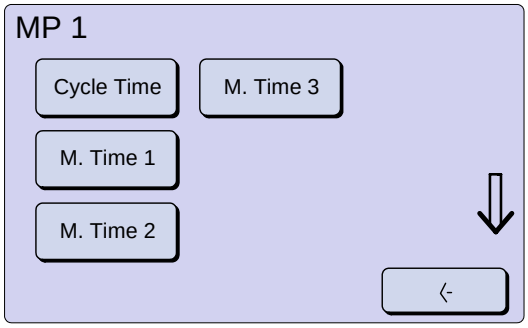


Fig. 3.57: Meas. Prog. Selection

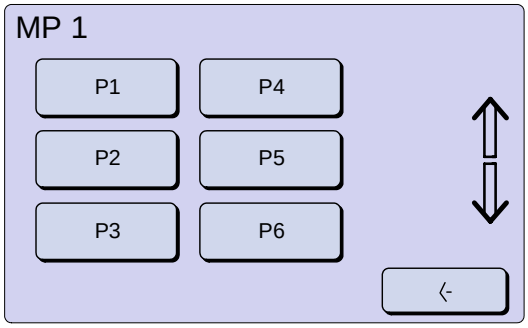


Fig. 3.58: Meas. Prog. Pumps

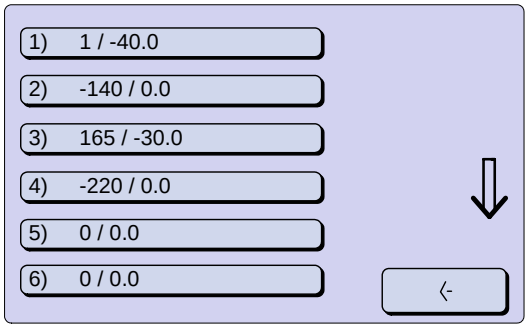


Fig. 3.59: Meas. Prog. Pump selection

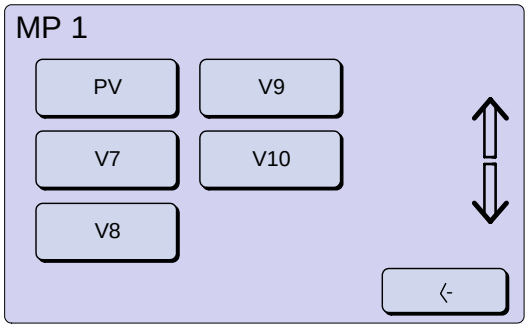


Fig. 3.60: Meas. Prog. Valves

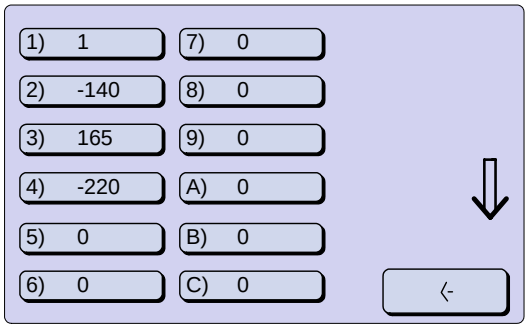


Fig. 3.61: Meas. Prog. Valve selection

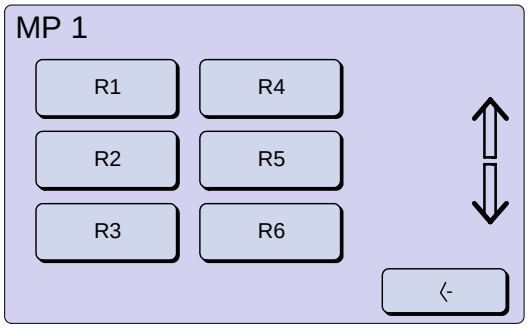


Fig. 3.62: Meas. Prog. Relay

Under item **Cycle Time** (see Fig. 3.57) the total cycle time of the measuring program can be determined and if applicable the time for the assumption of the results (**M.Time 1** to **3**). By pressing the corresponding keys the values can be entered via the numeric keypad.

Pressing the arrow keys will switch to further screens where all available outputs can be programmed. **P1** stands for the sample pump, **P2** to max. **P6** for all other pumps, **PV** for the sequentially controlled sample valves 1 to max. 6, **V7** for the optional calibration valve, **V8** for the drain valve, **V9** and **V10** for further optional valves and **R1** to max. **R12** for free assignable relay outputs.

The switching times for the outputs are entered respectively. Positive values mean that the output is switched, negative values mean that the output is switched off. Additionally the pump speed is entered and the direction of the sample pump is configured by negative or positive values. All entries are made via the numeric keypads which are located on the corresponding screens.

Stirrer

Some applications need a stirrer. Under the item **Stirrer** you can enter the stirring frequency via the numeric keypad.

Clean

Via **Clean** you determine whether the Cleaning is performed automatically and at which time. It is possible to initiate the cleaning always at the same time or after a certain interval (refer to the procedure **Menu – Calibration – Interval** Fig. 3.54).

Digestor

Here you enter whether an UV-Digestor is available or not **(OFF/ON)**. If an UV-Digestor is present the function of the UV-lamp is controlled automatically.

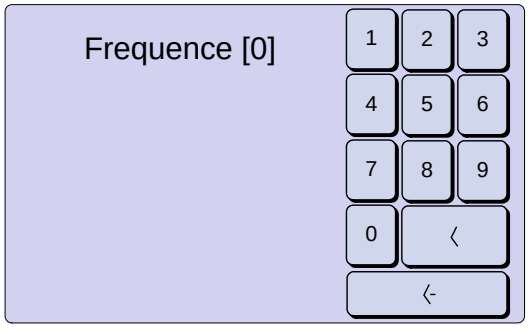


Fig. 3.63: Stirrer

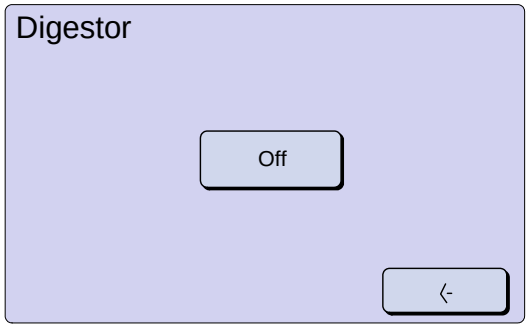


Fig. 3.64: Digestor

Device type (only Ionometer/Natriometer/Titrometer)

The item **Device type** is only shown with Ionometers (Natriometers) and Titrometers. By pressing the key you select between **Ionometer** and **Titrometer** and determine the mathematical algorithm (Kolorimeter/Silikometer are detected automatically and need no further configuration). With Titrometers the additional item **Config** is shown. Under this point further entries are made which depend on the type of application and are listed in the method description (refer to Appendix B in the User Manual).

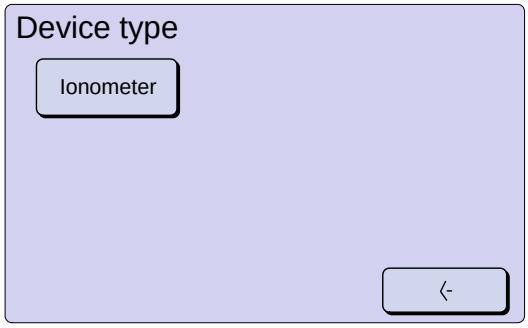


Fig. 3.65: Device type Ionometer

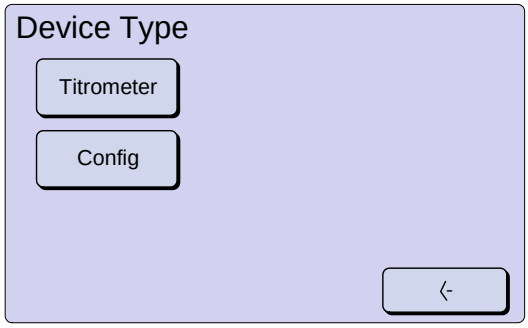
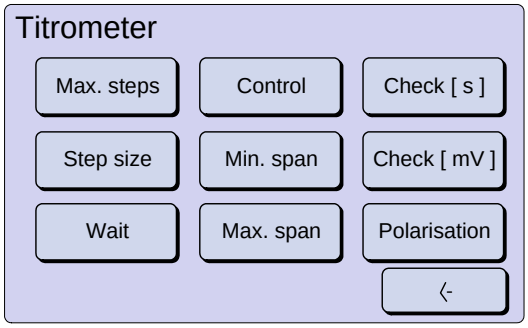


Fig. 3.66: Device type Titrometer



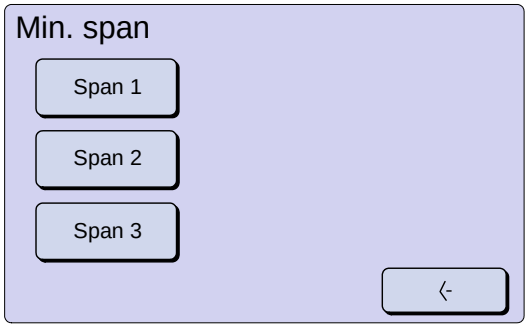


Fig. 3.67: Titrometer configuration **Fig. 3.68: Min. span**

Following settings can be made for the Titrometer

Steps	Under this point the max. number of the steps of a titration is shown and can be changed via the numeric keypad.. After each titration step and lapse of the latency time the voltage of the measuring system is taken for the determination of the indication point. If no sudden voltage variation is detected after the max. steps of the titration the cycle will be interrupted and the next measuring point will be analyzed. The max. measuring range is determined by the number of titration steps in combination with the step size and the concentration of the titrans.
S. Size	Under this point the actual step size of a titration step is shown as the number of rotations of the titration pump and can be changed via the numeric keypad. The step size can be 0.1 up to 1.0 rotations. Via the step size in combination with the used dosing tube it can be determined how much titrant will be added at each titration step.
Wait	Under this point the max. latency time between two titration steps is shown in seconds. Thereby the idleness of the measuring system can be compensated. If the requirements which are specified by **Check [s]** and **Check [mV]** are already met before the latency time has passed the next titration step will be performed. The latency time can be changed via the numeric keypad.
Check	The voltage variation per titration step grows constantly in front of an indication point and decline constantly after it. This continuity will be checked to identify the indication point clearly.
Min. Span	The Titrometer is able to perform max. 3-span-titrations. Via this point a lower potential limit is entered for each titration span that is used. (**Span 1** - **Span 3**, refer to Fig. 3.68). In combination with the entries under **Max. Span** a scope for each titration span is defined. For a valid measurement the large step change in voltage has to be within this scope.
Max. Span	Via this point the upper potential limit is entered. In combination with the entries under **Min. Span** a scope for each titration span is defined.
Check [s]	If the voltage variation of the measurement chain is below the value defined under **Check [mV]** within the time interval that is entered here in seconds, the next titration step will be performed– independently how much of the waiting time has passed. Thereby the duration of the titration can be shortened. The time interval can be entered via the numeric keypad.
Check [mV]	refer to **Check [s]**
Polarization	The polarization current µA is entered here. This is only necessary for applications which are working with the derivative amperometric titration (refer to the method description in Appendix B of the User Manual). With conventional titration it has to be 0 µA.

3.4.5 Service

Under this item stored data can be viewed, different operating modes of the system can be manually recalled and the operating hours counter can be configured as well as external sensors. The items **History**, **SystemVar**, **Status** and **Counter** are described below.

History

Stored data as calibration values, error messages and change in statuscan be viewed (the history of the results is accessible via the main display and **Results**, refer to section 3.3).

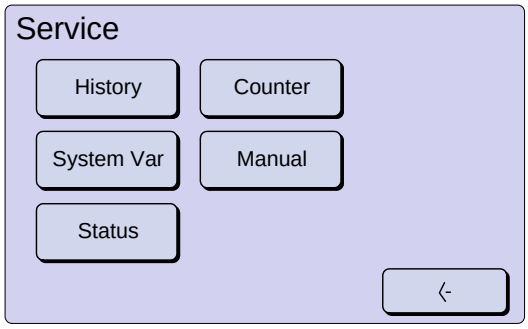


Fig. 3.69: Service

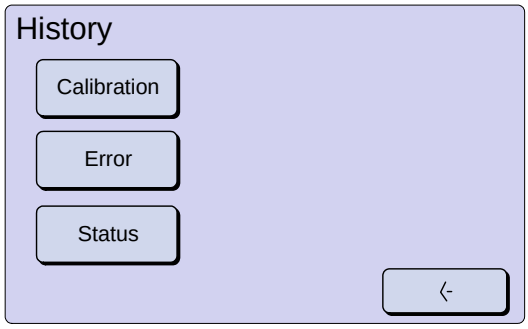


Fig. 3.70: History

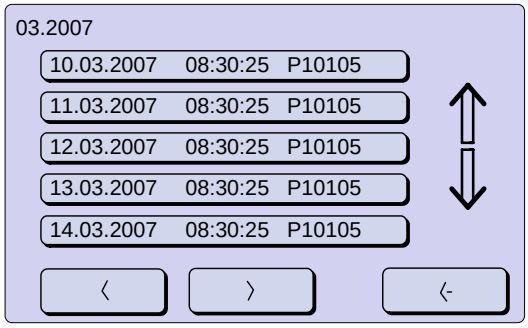


Fig. 3.71: Calibration history

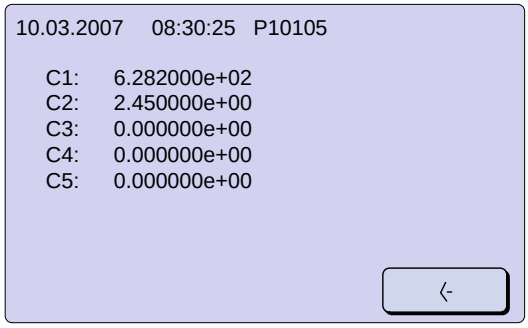


Fig. 3.72: Calibration values history

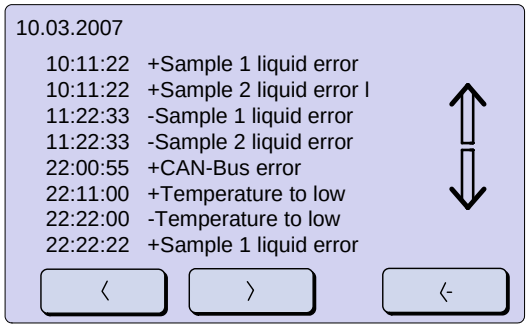

10.03.2007
10:11:22 +Sample 1 liquid error
10:11:22 +Sample 2 liquid error l
11:22:33 -Sample 1 liquid error
11:22:33 -Sample 2 liquid error
22:00:55 +CAN-Bus error
22:11:00 +Temperature to low
22:22:00 -Temperature to low
22:22:22 +Sample 1 liquid error

Fig. 3.73: Error history

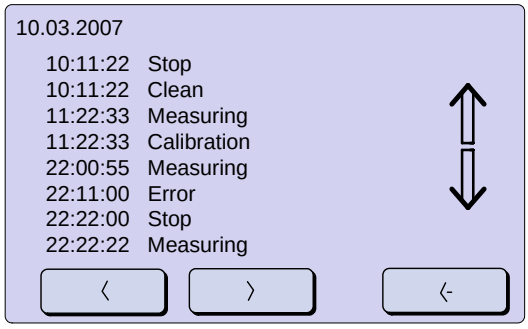


Fig. 3.74: Status history

Calibration lists all calibrations of the actual month which is shown on the upper left of the display. If there are more than 5 calibrations you can scroll by pressing the arrow keys on the right. Via the keys < and > you can switch to previous months. For each calibration the corresponding date, time and internal serial number of the mem-

ory card is shown on a key (see Fig. 3.71), The calculated calibration factors of this calibration are shown by pressing the key (see Fig. 3.72).

Error lists all error messages of the actual day together with the time of day. The date is shown on the upper left. If there are more than 8 error messages you can scroll by pressing the arrow keys on the right. A **+** is shown in front of the message if an error occurs. After the error has gone a **–** is shown in front of the message. Via the keys < and > you can switch to previous days. The error messages are listed in section 4.

Status lists all changes in status of the actual day together with the time of day. The date is shown on the upper left. If there are more than 8 error messages you can scroll by pressing the arrow keys on the right.

SystemVar

If external sensors are connected you can recall data (e.g. calibration values of the sensors) via this item. If no external sensors are connected an empty display will be shown.

Status

Under this item you can call the operating modes MEASURE; STOP; CALIBRATION and CLEAN. The current status is shown by an icon on the left bottom (refer to section 3.5). By pressing a key the PowerMon stops the actual operation and switches immediately to the selected mode. If Stop is selected the quit sequence is performed prior (refer to section 3.4.4, **sequence program – preclean**) to switch the device into safe condition.

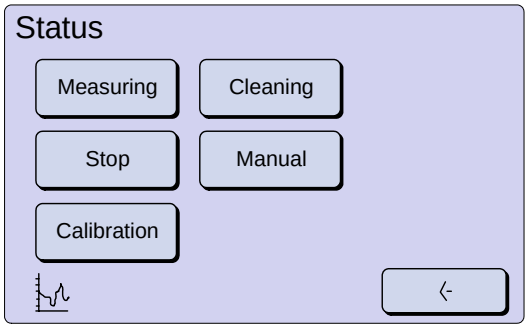


Fig. 3.75: Status

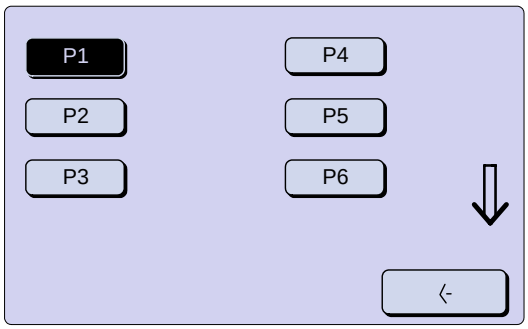


Fig. 3.76: Manual Pumps

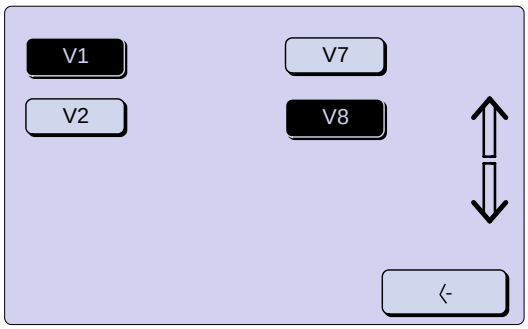


Fig. 3.77: Manual Valves

Additionally a manual control of the pump-, valve- and relay outputs is possible via the item **Manual**. By pressing the keys **P1**, etc. the pumps are switched on and off.

They operate at predefined speed and direction. Via the arrow keys further valve- and relay outputs are accessible. The example above shows that the pump valve P1, the sample valve V1 and the drain valve V8 are activated. If **Manual** is selected during another sequence program is running it will be interrupted and all outputs switch to passive state. If you leave this item all outputs are switched off again and the device returns to the former state.

Counter

Via the item **Counter** the 10 available operating hours counters can be shown, activated, deactivated (**ON/OFF**) and reset (**Reset,** see Fig. 3.79). Beside the keys you can see with which output the counter is associated, the actual counter reading and when the counter was reset last. The association of the counters, the alarm and the operation limits are predefined.

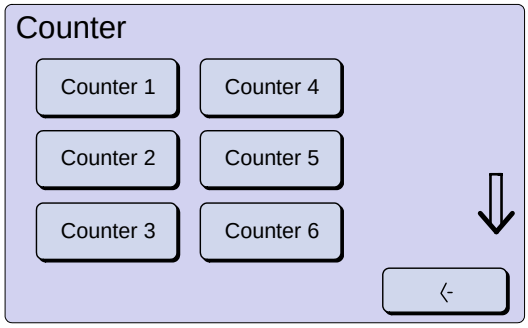


Fig. 3.78: Counter

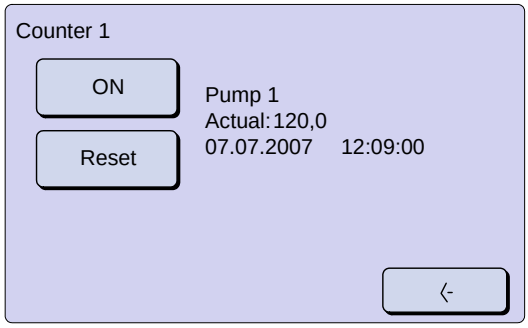


Fig. 3.79:Counter 1

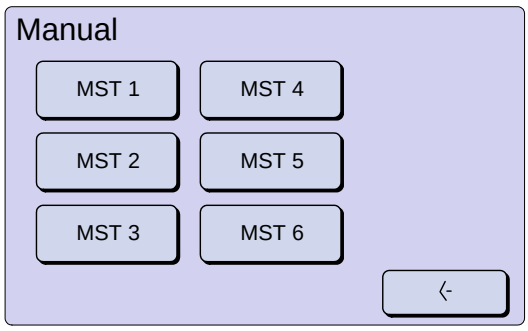


Fig. 3.80: Manual

Manual

Under the item **Manual** you see a selection of all measuring points. By pressing one of the keys MP 1 to MP 6 a measurement of the selected measuring point will be inserted after the actual cycle has finished. Afterwards the sequence will be further executed.

3.4.6 Help

Here you will find the address and contact information about Bran+Luebbe. Under **Info** information about the connected sensors, actuators, measuring points and the software version, the serial number, the commission number and the board software version of your device are listed.

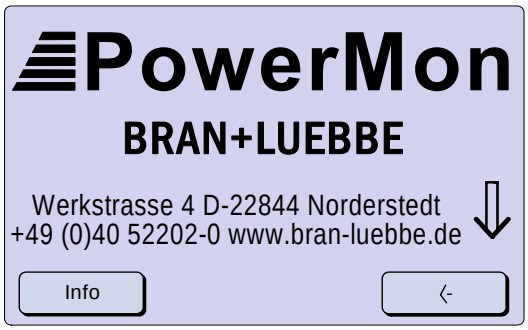


Fig. 3.81: Help

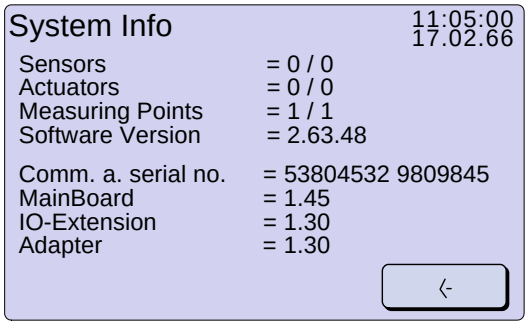


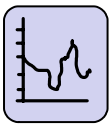
Fig. 3.82: Info (System)

3.5 Operating modes

The analyzer has five operating modes MEASURE, CALIBRATION, STOP, CLEAN and ERROR

The table below summarizes the operating modes. It is described how to enter and leave them, their purpose and how you can recognize whether they are activated.

Afterwards the operating modes are described more detailed.

Mode	Call	Display	Exit	Function
MEASURE	manual by **Menu - Service - Status - Measure**		Selection of another operating mode or if the system is in error condition, automatically if CLEAN or CALIBRATION is activated by the sequence or via time request	Measuring cycle is executed
CALIBRATION	Manual by **Menu - Service - Status - Calibration** or automatically after time request		automatically when the automatic calibration has completed, or by selection of another operating mode or if the system is in error condition	The system is calibrating
STOP	manual by **Menu - Service - Status - Stop**		Selection of another operating mode	All pumps and valves are switched off for maintenance work
CLEAN	manual by **Menu - Service - Status - Clean** or automatically after time request		automatically when the automatic calibration has completed, or by selection of another operating mode	Cleaning of the tubing, if **Stop** has been chosen the system cleans itself at predefined quit sequence
ERROR	Automatically in case of error that causes a system failure		automatically when the error has been eliminated	Measurement is interrupted, no automatic calibration any longer

3.5.1 Operating mode MEASURE

In the MEASURE mode the analyzer measures the concentration of the analyzed parameter in the sample and shows the current result and the number of the measuring point on the Touch Screen (Fig. 3.8).

For multi-stream systems the result from a specific sample stream is either shown continuously or the display shows the actual result, alternating for all measuring points in a 2 second interval.

The analysis sequence is specified in the program and will be executed automatically.

The system automatically checks whether limit values are exceeded, sample is present and the calibration parameters are plausible.

3.5.2 Operating mode CALIBRATION

The analyzer must be calibrated at regular intervals by activating the CALIBRATION mode. In this mode the corresponding valves are switched and the calibration solution(s) will be measured.

The calibration cycle can be started automatically, manually or externally if the system is configured respectively.

An automatic calibration requires stable calibration solutions. If this is not the case, the solutions must be newly-prepared and the calibration may only be initiated manually. The calibration frequency is adapted to the individual needs. A calibration each 24 hours is standard.

The system determines the calibration factors automatically and stores them. Warning- and operating limits are factory-programmed. At each calibration the system checks whether the limits have been exceeded or fallen below.

3.5.3 Operating mode STOP

The mode STOP should always be selected when routine maintenance work is performed, such as changing pump tubes or clearing leaks.

Entering and leaving STOP mode:

The mode is called by pressing **Menu – Service – Status – Stop**. The current executing analysis or calibration cycle will be interrupted immediately. A predefined interruption sequence is activated which will clean the system if necessary and shift the system into a harmless status. Only after that the system stops, all pump are switched off and the valves are closed. The measuring results persist. If the system has a controlled heating, the control continues.

STOP can also be initiated externally if the digital inputs are programmed accordingly.

Warning:
Power off the system when working on heated elements (flow cell and electrodes). Otherwise there is a risk of incineration and the heating elements can burn through.

The mode is also accessible in case of an error message.

The STOP mode is abandoned by selection of another operating mode.

3.5.4 Operating mode ERROR

It is important that the system checks itself continuously. The PowerMon differs between two kinds of errors.

Soft errors, resp. failures which disturb the measurement, e.g. malfunction of a measuring point, result in an error or warning message. The key with the symbol **!** flashes on the main display until the message is receipted or the failure is cleared. (**!** is not shown any longer). The measurement continues.

The system shifts automatically to the ERROR mode in case of hard errors as failures within the analysis cycle, breakdown of components or data transfer failure within the system .

If this happens, the system reacts as follows:

- The measurement is interrupted
- Calibration is impossible
- System alarm output is activated
- A corresponding error message is shown on the Touch Screen and has to be receipted

In the ERROR mode you can select the operating mode STOP. Both operating modes are active simultaneously. All functions are available.

If the fault is fixed, the system returns automatically to the MEASURE mode. If the fault is not fixed the ERROR mode persists.

Not all errors cause a system failure. Details about the different errors, the consequences and the countermeasures are described in the User Manual (section 5 "Troubleshooting") and in this manual (section 4 “Error messages”).

4 ERROR MESSAGES

4.1 Overview

This chapter contains a general survey of the error messages that can be generated by the PowerMon and the associated consequences. In general there are two classes of errors. Error class 1 and error class 2.

If class 1 errors arise the system switches to the STOP mode, a system alarm will be set and the corresponding error message is shown. To start the measurement again it is necessary to remove the cause, to receipt the error and to start the measurement manually.

In case of class 2 errors (e.g. low sample) the measurement will continue and the error message will be shown on the display for about 15 seconds. Afterwards the warning message **!** flashes in the main display as long as the message remains.

4.2 Error messages overview

Query	Error class	Error message	Consequence
System	1	Memory error	STOP – Error message – System alarm
		CAN Bus error	
		Calculation formula 1 missing	
		Calculation formula 2 missing	
		Conductivity sensor failed	
		Pump speed 1 incorrect	
		Leak alarm	
		Photometer failure	
		Measuring chain	
	2	UV-Digestor failed	Error message – device continues operation
Liquid detector	2	Sample 1 - 6 lack alarm	Measurement stops – Error message – selection of next MP.
		Dilution lack alarm	
		Calibration solution lack alarm	Calibration program stops - Error message - Measurement continues with old calibration values.
	1	Reagent 1 - 5 lack alarm	STOP – Error message – System alarm
Heating	1	Temperature sensor short-circuit	STOP - Error message – System alarm
		Temperature sensor cable broken	
		Heating safety shutdown	
	2	Temperature too high	Error message – device continues operation
		Temperature too low	
Operating hours counter	2	Warning limit per output*)	Error message – device continues operation
	1 or 2*)	Operation limit per output*)	STOP – Error message – System alarm or Error message – device continues operation, *): defined by operator
Limits	2	MP 1 – 6 upper limit exceeded	Error message – device continues operation
		MP 1 – 5 lower limit exceeded	
Calibration	2	Upper warning limit	Error message - Calibration will be repeated once. If the error occurs again – Error message – Measurement continues
		Lower warning limit	
	1	Upper operation limit	Error message - Calibration will be repeated once. If the error occurs again – Error message – System alarm
		Lower operation limit	

Anhang A Index

A

activate measuring point 16
analog current output 16
Application 18

C

Calibration 19
  automatic 29
  concentrations 19
  factors 19
  interval 19
  start 29
CALIBRATION (Operating mode) 29
Calibration factors 29
Clean 21
CLEAN (Operating mode) 28
contact 26
conventions 2
conversion factor 16
counter 26

D

Date and clock
  time 11
Date and time
  timedrift 11
  timezone 11
diagram 9
device type
  Titrometer 22
Device type 22
  Ionometer) 22
Digestor 22
digital input 17
display see Touch Screen

E

Error
  system failure
    display 30
  system Failure
    consequences 30
ERROR (Operating mode) 28
ERROR (Operating mode) 30

F

Factor 16

G

Gateway 11
GPS 13

H

Heating 19
Heating circuit 19
Help 26
history
  calibration 24
  error messages 24
  status 24
History 24

I

info
results 10
Info
GPS 13
Modem 13
Network 11
input
digital 17
IP-Address 11
IP-Netmask 11

L

Language 14
limits 29
Limits 16
alarm 16
measuring range 16

M

manual 26
Manual control 25
MEASURE (Operating mode) 28
Measuring point
activate 16
Measuring Points 14
Measuring range 16
menu
main 10
Modem 12

N

Netmask 11
Network 11

O

Offset 16
Operating hours counter 26
Operating mode CALIBRATION 29
Operating mode CLEAN 28
Operating mode ERROR 30
Operating mode ERROR 28
Operating mode MEASURE 28
Operating mode SERVICE 28, 29
Operating modes
overview 27
output
current output 16

P

Parameter 14
Program 20
calibrate 20
Clean 20
cycle time 21
Measure 20
preclean 20
sequence 20

R

results 8

S

safety advices 3
symbols 2
Sensorlist 14

Service 23
SERVICE (Operating mode) 28
signal input 17
signal output
analog 16
software version 26
system 10
Status 25
Stirrer 21
System failure 30
SystemVar 25

T

Time 11
Timeserver 11
Touch Screen 5
figure 5
table 8

U

UV-Digestor 22